such amendment as shall secure evidence of a reasonable degree of capacity for science on the part of every probationer, whilst it would be well also if it could be made to encourage a rather wider range of literary study in the earlier education of those whose main interests lie in the direction of science. What is desirable could be attained in several ways. But it could, perhaps, be best effected by permitting candidates to offer themselves for examination in three subjects instead of two from Class II.; with the limiting condition that one at least of these three must be taken from numbers 5, 6, 7, 8, and one of them from 9, 10, 11, 12.

We trust that this subject may also be brought under the notice of the authorities at the India Office. It seems evident from the changes already made that they are in no way prejudiced against either scientific or literary studies, and we feel sure that if they will institute inquiries they will find that similar opinions to those we have expressed are widely held on this subject.

THE VOLCANOES OF HAWAII.

Characteristics of Volcanoes, with Contributions of Facts and Principles from the Hawaiian Islands: including a Historical Review of Hawaiian Volcanic Action for the past Sixty-seven Years, a Discussion of the Relations of Volcanic Islands to Deep-sea Topography, and a Chapter on Volcanic-Island Denudation. By James D. Dana. Illustrated by Maps of the Islands; a Bathymetric Map of the Atlantic and Pacific Oceans; and Views of Cones, Craters, a Lava-Cascade, a Lava-Fountain, &c. (London: Sampson Low, Marston, Searle, and Rivington, 1890.)

THE veteran geologist of the United States has rendered an inestimable service to science by the publication of this splendid monograph, which has just made its appearance simultaneously in this country and in the United States. To find any work on a similar subject comparable with it either in importance, or in the influence it is likely to exert upon geological thought, we must go back to the publication of Fouqué's "Santorin," of Von Waltershausen's "Etna," or Scrope's "Volcanoes of Central France."

The Hawaiian volcanoes are unquestionably the grandest on the face of the globe. Their vast dome-shaped masses, with slopes averaging from 6° to 8°, rise to heights of only 14,000 feet above the sea-level; but deep-sea soundings have shown that they stand on a floor 12,000 to 18,000 feet below that level, so that, as Prof. Dana points out, the higher volcanic mountains of the Sandwich Islands must have an elevation of not far from 31,000 feet above their bases! Beside these lofty and bulky domes, the graceful volcanic cones of the North and South American continents, of Japan and Java, sink into insignificance. The Hawaiian Archipelago contains no less than fifteen volcanoes of the first class, all but three of which appear to be now extinct. The active volcanoes of Hawaii give rise to lava-floods, which, in their bulk and in the distances they flow from their point of emission, are only surpassed by those of Iceland. In their remarkably non-explosive action, in the characters of their great pit-craters, in the wonderful liquidity of their lavas—giving rise to veritable fountains of molten rock—and in the beauty and singularity of some of their igneous products, the Hawaiian volcanoes are without a parallel anywhere else in the world.

The Hawaiian volcanoes appear to form two nearly parallel bands, which doubtless indicate great lines of fissure in the earth's crust, the extreme length of these being about 400 miles. The recent topographical surveys of the islands made by Prof. W. D. Alexander, Surveyor-General to the Hawaiian Government, and a number of recent soundings in the adjoining seas, enable us to realize, in a way that was not previously possible, the dimensions and forms of these vast volcanic piles.

Prof. J. D. Dana has enjoyed exceptional facilities for studying these unique centres of igneous activity. As naturalist of the U.S. Exploring Expedition, he visited the islands in November 1840, after the great eruption of Kilauea that had taken place in May of the same year. The work of the actual survey and description of the craters was unfortunately not committed to Prof. Dana; for the energetic, though scientifically untrained, head of the Expedition, Captain Wilkes, determined to undertake this task himself; and the naturalist was sent away to another station while the survey was in progress. Had Prof. Dana been present to advise and assist the surveying officers, it is clear that many unfortunate errors would have been avoided, and that the accounts of the volcanoes contained in the "Narrative of the United States Exploring Expedition" would have had far greater scientific value.

After his return to the States and his settlement at Yale College, Prof. Dana showed his continued interest in the Hawaiian volcanoes, by keeping up a constant correspondence with missionaries and other residents in the islands; and every great eruption was carefully chronicled in the pages of the *American Journal of Science*, which he has so long edited. The memoirs of Brigham and Captain Dutton, and the enlargement and correction of our topographical knowledge of the islands, resulting from the Government survey, seem once more to have aroused the author to a sense of the importance of the subject, and in 1887 he commenced a series of papers on the history of the changes in the Mount Loa craters. He had not proceeded far with this work, however, before he felt the need of a second personal examination of the district. With characteristic energy, he undertook, in spite of his advancing years, a ten-weeks' journey, involving over ten thousand miles of travel, in which he visited all the chief points of interest; and the book before us is the outcome and monument of his labours.

The work of criticizing and reconciling the accounts given by numerous travellers, beginning with notices written as long ago as the year 1823, has been admirably performed by Prof. Dana. Without his personal knowledge of the localities, and the aid afforded by the new and accurate maps of the islands, the task would, indeed, have been a hopeless one; for many of the descriptions were penned by unscientific and careless writers, and inaccuracies and exaggerations are encountered at every step. By sifting and correlating this confusing mass of evidence, however, the author is able to give a clear and connected narrative of the changes in the Kilauea crater, and to illustrate the position of its floor after each of the great eruptions, which took place in 1823, 1832, 1840, 1868, and 1886. The result is that we are furnished for the

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first time with the means of judging of the real nature of the processes going on in the pit-craters of non-explosive volcanoes. A similar discussion of the records concerning Mokuaweoweo, the summit-crater of Mount Loa, enables the author to furnish an interesting, but necessarily less complete, narrative of the operations going on there during the same period. The want of anything like synchronous action between these two great craters in the same mountain-mass, *one of which is at an elevation of* 10,000 *feet above the other*, has often been remarked upon; and the truth of the conclusion—one which must always be taken account of in attempts to explain volcanic phenomena—is fully established in the work before us.

Prof. Dana forcibly illustrates the remarkable contrast between the effusive eruptions of the Hawaiian volcanoes with their extremely liquid and perfectly fused basaltic lavas, and the explosive outbursts of Vesuvius, Krakatão, and Tarawera. He describes the characters and limited distribution of the curious glassy lavas, and their derivatives—the curious Pele's hair and the beautiful "thread-lace scoriæ"; and he points out the inaccuracy of the early chemical analyses of the Hawaiian lavas, which have misled so many subsequent writers. His remarks on the characteristics and origin of the chief varieties of the lava, and especially of the pseudo-bombs—vast pillow-like masses of lava covered with a thin vitreous crust—are remarkably interesting and suggestive.

One of the most valuable chapters in the book is that on the petrographical characters of the Hawaiian lavas, supplied by the author's son, Prof. E. S. Dana. The singular fissile basalts of the higher cone, which resemble phonolite, and several other remarkable types are here described for the first time. Very noteworthy are the curious feathery forms of augite which occur in some lavas, and the strangely-elongated crystals of olivine which are found in others. But the part of the chapter which will unquestionably awaken the greatest amount of interest in the minds both of mineralogists and geologists is that which deals with the curious stalactites found in certain caverns in the lavas. That these stalactites are formed by aqueous action there cannot, as Prof. E. S. Dana shows, be any reasonable doubt. Yet the stalactites are built up of crystals of felspar, augite, and magnetite, all the constituents formed by igneous action in the lavas themselves, being present, with the exception of olivine! All students of mineral synthesis are acquainted with the fact that the same species can often be formed by several, and sometimes by very diverse, methods. Mr. Sorby has even shown how fragments of quartz-crystals, originally formed in a granite or other igneous rock, may after enormous intervals renew their growth and become complete crystals again under purely aqueous conditions; so that the same crystal may in different parts be the result of totally different kinds of action. In spite of these facts, however, few petrographers would be prepared to find that, from aqueous solutions, rocks made up of felspar, augite, and magnetite could be formed in the way described in this interesting essay. Prof. E. S. Dana not unnaturally announces these remarkable conclusions with some diffidence and reserve; yet it is impossible to find any flaw whatever in the line of argument by which he seeks to establish their truth.

Prof. J. D. Dana has prefaced his description of the Hawaiian Islands by a sketch to which the title of "Characteristics of Volcanoes" is more directly applicable. In this introduction, which only extends to some 27 pages, many of the great problems of vulcanology are discussed with singular clearness and freedom from bias.

The work concludes with two interesting appendices, the first on "Volcanoes and Deep-sea Topography," and the second on "Denudation of Volcanic Islands; its Amount a Mark of Age." The book is well illustrated with maps and sketches, and some plates reproducing photographs will serve to give a just idea of the peculiar lava cascades and fountains of Hawaii—phenomena which have not unnaturally excited the imagination of untrained observers, and given rise to startling drawings and florid descriptions in popular works of travel. But the sober truth is, that the wonders of Hawaii stand in no need either of exaggeration or embellishment from the writer or the artist.

We heartily welcome the volume as the crowning labour of the greatest of America's men of science—the latest, and not by any means the least important, of a long series of contributions to science on very diverse subjects, but of unvarying excellence. J. W. J.

A POLYGLOT MEDICAL VOCABULARY.

Terminologia Medica Polyglotta: a Concise International Dictionary of Medical Terms. Compiled by Theodore Maxwell, M.D. Cantab. (London: Churchill, 1890.)

THE current literature of medical subjects is extensive and polyglot, and those who endeavour to keep themselves abreast of the most recent research in any branch require to dip into works in many languages, and need to have at hand some such aid as the present vocabulary, wherein they can seek for the several vernacular synonyms of those newer technicalities which modern developments of science have produced, and which are not to be found in the ordinary dictionaries. Moreover, it is often necessary that the special senses in which some of the older and more general words are used by medical writers should be defined. One may be very well acquainted with the anatomy of the brain as described in the English standard works, and yet have much difficulty in following the descriptions in German or French books on cerebral pathology, when vernacular names are used for the several parts; and one longs for some international agreement as to a uniform system of scientific terminology like the Latin generic and specific names of the Linnæan nomenclature.

The compilation of a new dictionary is a task involving an enormous amount of labour, and when, as in the work under notice, the synonyms of each term in seven languages have to be sought and tabulated, the difficulties of the undertaking are seriously increased. The compiler has evidently expended great care, and exercised much judgment in his toilsome task, and doubtless this vocabulary will prove of much help and be highly appreciated by students of foreign medical literature. The typography is excellent and clear, and the work is singularly free from errors of the press.

It is questionable whether the selection of French as the fundamental language was a wise choice. There are

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